Physical and Chemical Changes
Pre-AP

Objectives

- Make observations of the starting materials, during the reaction and then after the reaction
- Observe and identify for any physical changes
- Predict whether experiment is chemical or physical and provide reason

If you break a piece of chalk, it loses its original size and shape. You have caused a change in some of its physical properties, but you have not changed the identity of the substance that makes up the chalk. This type of a change is called a physical change and it happens when substances freeze, boil, evaporate, or condense. These transformations may require energy, or may release energy, but the components that make up the substance do not change identity. An element, like iron, will change states if it is allowed to absorb enough energy, but it will still have physical properties that will identify it as iron.

Matter can also undergo transformations which result in a change in the identifying properties of the components that make up the substance, take a piece of iron, Fe, left in the rain for weeks that rusts or becomes Fe_2O_3. This type of change is called a chemical change. Fireworks exploding, matches burning, eggs rotting and glow stick glowing are all examples of chemical changes - changes where new materials are formed that were not there before. Most chemical changes can be identified by at least one of four clues which indicate a chemical change has occurred: a gas can be given off, a new color can appear, heat and light can be given off, or a precipitate can be formed. Each of these is evidence that a new substance has formed.

Safety: See each station procedure

Pre lab Questions

1) When we make observations in chemistry class, we describe certain physical properties of objects or chemicals. List the 10 different kinds of physical properties that we have learned.

2) What is a physical change?

3) What is a chemical change? What are the types of "evidence" for a chemical change?

4) In your own words, what is the difference between a chemical change and a physical change?

*5) To the left of each sentence, identify each of the following as a physical or a chemical change. Then, **explain why** each is a chemical or physical change under the sentence.*

a. You leave your bicycle out in the rain and it rusts.
b. A sugar cube dissolves in water.
c. Pure potassium is normally stored in oil. When the oil is removed, a flame is produced because the potassium can now react with oxygen in the air.
d. Sand is mixed with water.

e. Scientists break up water (called hydrolysis) up by separating it into O_2 and H_2
f. You are cleaning your bathroom and you accidentally mix bleach and ammonia, which produces a toxic gas, which makes you pass out.

g. Burning char-coal for a barbecue.
h. Chewing up a bite of hamburger.
i. You take a shower and your wet hair begins to dry.
j. Silver nitrate and sodium chloride mix to form a grey-violet precipitate.
k. Trimming a plant because it has grown too high.
l. Mashing up potatoes to make mashed potatoes.
m. Sodium polyacrylate and water mix in a bowl to form a gel. When the water evaporates, the sodium polyacrylate reappears.
n. Hydrogen peroxide is poured on some liver the liver begins to break down, and bubbles form.
o. Write your own example here and identify it as a chemical or physical change, and explain:

6) Identify each statement as being true or false to the left of the sentence.

a. A change in size or shape is a physical change.
b. A chemical change means a new substance with new properties was formed
c. An example of a chemical change is when water freezes.
d. When platinum is heated, then cooled to its original state, we say this is a physical change.
e. When milk turns sour, this is a physical change because a change in odor does not indicate a chemical change.
f. When magnesium is burned, ash forms. We say this is a physical change because the magnesium looks different.
g. When citric acid and baking soda mix, carbon dioxide is produced and the temperature decreases. This must be a chemical change.
h. Write your own true false question here and answer it yourself.

Post lab Questions:

1. List four (4) different changes you saw and describe what those changes looked like (2 chemical and 2 physical).

2. How can you tell by observation only if a change in chemical or physical?

3. When you heated the cobalt (II) chloride hexahydrate, what happened to the color?
   a. When you added water back to the anhydrous (w/o water) cobalt (II) chloride, what did you observe?
   b. Why is this a chemical or physical change, be specific.
   c. Try to explain how water affects the color of this material; come up with your own scientific mechanism.

4. When you mixed the KI and $Pb(NO_3)_2$ together (both clear liquids) why did a solid form, try to explain this based on what you know.
   a. Why was it a chemical or physical change?
5. Recalling any of the previous environmental disasters (tanker spills in Canada, BP Gulf Oil Rig, etc), what where the physical and chemical changes associated with them and how what the damaged treat/ cleaned up? You may need to research this.

Data table

Station #	Starting Materials	3 Observations of starting materials	3 Observations during Rxn	3 Observations after rxn	Chemical Or Physical Change?

Station 1 Procedure: Mg and HCl

Caution: HCl is a very strong acid.

1. Place a 1.0cm piece of Mg ribbon in a test tube.
2. Add 10 drops of HCl and observe for 30s.
3. Remove the Mg, dump the excess HCl in the waste container, and rinse test tube.

Station 2 Procedure: Heating Sucrose

Caution: Test tube very hot

1. Put about half the volume occupied by an m&m or skittle ($0.5cm^3$) of sucrose in a small test tube.
2. Using the test tube tongs, heat the sucrose gently in the flame (about 7cm above Bunsen Burner) for 90-120s. Observe, what you see, be specific and detailed, draw what you see.
3. Turn off Bunsen burner, wait for the tube to cool and dispose of it in the waste bin at the station.

Station 3 Procedure: Silver nitrate and Hydrochloric acid

Caution: HCl is a very strong acid.

1. Place 5 drops silver nitrate, $AgNO_3$, into a medium test tube.
2. Replace cap. Add 5 drops hydrochloric acid, HCl(aq). Observe, what you see, be specific and detailed, draw what you see. Rinse, clean, and dry test tube in sink.

Station 4 Procedure: Potassium iodide and lead nitrate

Caution: Both of these liquids are toxic

1. Add 5.0ml of potassium iodide, KI, to test tube, using the KI graduated cylinder.
2. Add 5.0 ml $Pb(NO_3)_2$ to test tube, using the lead (II) nitrate, $Pb(NO_3)_2$, graduated cylinder. Observe, what you see, be specific and detailed, draw what you see.
3. Dispose of this material in the waste container at the station, and rinse, clean, and dry test tube in sink.

Station 5 Procedure: Sodium Hydroxide and Aluminum foil

Caution: NaOH(aq) is very corrosive

1. Place 4-5 small pieces of Al foil in the 150ml beaker.
2. Add about 15-20ml of 3.0M sodium hydroxide, NaOH(aq), to the foil. Observe for 30s.
3. Using tweezers, lift out foil and put in the solid waste beaker.
4. Dump excess NaOH in waste appropriate waste beaker at station and clean reaction beaker in sink.

Station 6 Procedure: $CoCl_2 \cdot 6H_20$ and heat

1. Place ~1.0 g of cobalt chloride hexahydrate, $CoCl_2 \cdot 6H_20$, in the crucible.
2. Heat the solid ***slowly***. Record your observations.
3. Allow the crucible to cool to 30-40C (use IR temp gun).
4. Add 10 drops of water to the solid in the crucible. Record your observations in Table 1.
5. Rinse the remains into the appropriate waste beaker at station.

Station 7 Procedure: H_2O and NH_4NO_3

1. Using the thermometer, approximate the temperature of water in the beaker at the table.
2. Add 20ml of the water from the beaker to the large test tube.
3. Place about half a scoop (marble size, 1.00-1.50cm^3)) of ammonium nitrate, NH_4NO_3, into the test tube and swirl.
4. After 60s, measure temperature of mixture and record observations. Rinse test tube into the appropriate waste beaker at station.